Atom Optics

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Optics in Our Time

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LAYLAH ASHLEY

Optical Resonance and Two-Level Atoms Springer Science & Business Media Includes the full text of the invited lectures and abstracts of the contributed papers from the Seminar on Fundamentals of Quantum Optics.

Atom Interferometry Springer Nature Provides fully updated coverage of new experiments in quantum optics This fully revised and expanded edition of a well-established textbook on experiments on quantum optics covers new concepts, results, procedures, and developments in state-of-the-art experiments. It starts with the basic building blocks and ideas of quantum optics, then moves on to detailed procedures and new techniques for each experiment. Focusing on metrology, communications, and quantum logic, this new edition also places more emphasis on single photon technology and hybrid detection. In addition, it offers end-of-chapter summaries and full problem sets throughout. Beginning with an introduction to the subject, A Guide to Experiments in Quantum Optics, 3rd Edition presents readers with chapters on classical models of light, photons, quantum models of light, as well as basic optical components. It goes on to give readers full coverage of lasers and amplifiers, and examines numerous photodetection techniques being used today. Other chapters examine quantum noise, squeezing experiments, the application of squeezed light, and fundamental tests of quantum mechanics. The book finishes with a section on quantum information before summarizing of the contents and offering an outlook on the future of the field. -Provides all new updates to the field of quantum optics, covering the building blocks, models and concepts, latest results, detailed procedures, and modern experiments -Places emphasis on three major goals: metrology, communications, and quantum logic -Presents fundamental tests of quantum mechanics (Schrodinger Kitten, multimode entanglement, photon systems as quantum emulators), and introduces the density function -Includes new trends and technologies in quantum optics and photodetection, new results in sensing and metrology, and more coverage of quantum gates and logic, cluster states, waveguides for multimodes, discord and other quantum measures, and quantum control - Offers end of chapter summaries and problem sets as new features A Guide to Experiments in Quantum Optics, 3rd Edition is an ideal book for professionals, and graduate and upper level students in physics and engineering science.

Atoms, Molecules and Optical Physics 1 Springer This book gathers the lecture notes of courses given at Session CVII of the summer school in physics, entitled "Current Trends in Atomic Physics" and held in July, 2016 in Les Houches, France. Atomic physics provides a paradigm for exploring few-body quantum systems with unparalleled control. In recent years, this ability has been applied in diverse areas including condensed matter physics, high energy physics, chemistry and ultra-fast phenomena as well as foundational aspects of quantum physics. This book addresses these topics by

presenting developments and current trends via a series of tutorials and lectures presented by international leading investigators.

Quantum Optics VI National Academies Press

Evanescent waves have become increasingly important to many areas of physics and optical engineering. This book is the first comprehensive presentation on the topic, covering the role of evanescent waves in areas such as guided optics, optical-fiber couplers, integrated optical elements, internal reflection spectroscopy, atom optics, dark-field microscopy, scanning tunneling optical microscopy, microaperture microscopy, and apertureless microscopies.

Atom Optics and Space Physics National Academies Press

Intrinsic features of the optical near field open a new frontier in optical science and technology by finally overcoming the diffraction limit to reach nanometric dimensions. But this book goes beyond near-field optical microscopy to cover local spectroscopy, nanoscale optical processing and storage, quantum near-field optics, and atom manipulation. Near-Field Nano/Atom Optics and Technology provides the first complete and systematically compiled account of the science and technology required to generate the near field, and features applications including imaging of biological specimens and diagnostics for semiconductor nanomaterials and devices. This monograph will be invaluable to researchers who want to implement near-field technology in their own work, and it can also be used as a textbook for graduate or undergraduate students.

The Physics of Laser-Atom Interactions Springer Science & Business Media

This is the second volume of textbooks on atomic, molecular and optical physics, aiming at a comprehensive presentation of this highly productive branch of modern physics as an indispensable basis for many areas in physics and chemistry as well as in state of the art bio- and material-sciences. It primarily addresses advanced students (including PhD students), but in a number of selected subject areas the reader is lead up to the frontiers of present research. Thus even the active scientist is addressed. This volume 2 introduces lasers and quantum optics, while the main focus is on the structure of molecules and their spectroscopy, as well as on collision physics as the continuum counterpart to bound molecular states. The emphasis is always on the experiment and its interpretation, while the necessary theory is introduced from this perspective in a compact and occasionally somewhat heuristic manner, easy to follow even for beginners.

Quantum Optics World Scientific

From the reviews: "This is a book that should be found in any physics library. It is extremely useful for all graduate students, Ph.D. students and researchers interested in the quantum physics of light." Optics & Photonics News

Near-Field Nano/Atom Optics And Technology Cambridge University Press

The rapid development of quantum technologies has driven a revolution in related research areas such as quantum computation and communication, and

quantum materials. The first prototypes of functional quantum devices are beginning to appear, frequently created using ensembles of atoms, which allow the observation of sensitive, quantum effects, and have important applications in quantum simulation and matter wave interferometry. This modern text offers a self-contained introduction to the fundamentals of quantum atom optics and atomic many-body matter wave systems. Assuming a familiarity with undergraduate quantum mechanics, this book will be accessible for graduate students and early career researchers moving into this important new field. A detailed description of the underlying theory of quantum atom optics is given, before development of the key, quantum, technological applications, such as atom interferometry, quantum simulation, quantum metrology, and quantum computing.

Frontiers of Laser Physics and Quantum Optics Elsevier

The goal of this volume is to discuss the rapidly moving field of atom optics and interferometry with all its intricate aspects ranging from fundamental physics to applications and the theory of relativity. The breathtaking success in manipulating atoms using lasers has encouraged these two so far disjunct communities to move closer together and begin collaborations. After an introduction to atom optics and Bose-Einstein condensation, the theoretical foundations of cold atom interferometers, their use to test gravity, and their implementation in laboratory measurements of the Earth rotation and of Newton's gravitational constant are discussed. Several papers discuss the characteristics of gyroscopes and interferometers as sensors for inertial forces, starting from gyroscopes based on light waves and comparing their sensitivity to those based on matter waves. The final topic is the variation of fundamental constants, a subject that during the last years has attracted a lot of attention from different communities of physics.

Laser Cooling and Trapping Cambridge University Press

This volume contains the index for volumes 1-38 in the Advances in Atomic, Molecular, and Optical Physics series.

Atoms, Molecules and Optical Physics 2 Springer Science & Business Media

The field of atom interferometry has expanded rapidly in recent years, and todays research laboratories are using atom interferometers both as inertial sensors and for precision measurements. Many researchers also use atom interferometry as a means of researching fundamental questions in quantum mechanics. Atom Interferometry contains contributions from theoretical and experimental physicists at the forefront of this rapidly developing field. Editor Paul R. Berman includes an excellent balance of background material and recent experimental results,providing a general overview of atom interferometry and demonstrating the promise that it holds for the future. Includes contributions from many of the research groups that have pioneered this emerging field Discusses and demonstrates new aspects of the wave nature of atoms Explains the many important applications of atom interferometry, from a

measurement of the gravitational constant to atom lithography Examines applications of atom interferometry to fundamentally important quantum mechanics problems

From Atom Optics to Quantum Simulation Springer Science & Business Media

This book deals specifically with the manipulation of atoms by laser light, describing the focusing, channeling and reflection of atoms by laser fields. It also describes the potential fields required to cause the phase change of the wave function necessary for the atomic interactions to occur.

A Guide to Experiments in Quantum Optics Springer

Praise for Previous Volumes "This volume maintains the authoritative standards of the series...The editors and publishers are to be congratulated" - M.S. CHILD in PHYSICS BULLETIN "Maintains the high standards of earlier volumes in the series...All the series are written by experts in the field, and their summaries are most timely...Strongly recommended." - G. HERZBERG in AMERICAN SCIENTIST

Controlling the Quantum World Princeton University Press

Since the advent of the laser about 40 years ago, the fields of laser physics and quantum optics have evolved into a major disciplines. The early studies included optical coherence theory and semiclassical and quantum mechanical theories of the laser. More recently many new and interesting effects have been predicted. These include the role of coherent atomic effects in lasing without inversion and electromagnetically induced transparency, atom optics, laser cooling and trapping, teleportation, the single-atom micromaser and its role in quantum measurement theory, to name a few. The International Conference on Laser Physics and Quantum Optics was held in Shanghai, China, from August 25 to August 28,1999, to discuss these and many other exciting developments in laser physics and quantum optics. The international character of the conference was manifested by the fact that scientists from over 13 countries participated and lectured at the conference. There were four keynote lectures delivered by Nobel laureate Willis Lamb, Jr., Profs. H. Walther, A.E. Siegman,and M.O. Scully. In addition, there were 34 invited lectures, 27 contributed oral presentations, and 59 poster papers. We are grateful to all the participants of the conference and the contributors of this volume.

Theoretical Atomic Physics Cambridge University Press

This thesis explores ultracold quantum gases of bosonic and fermionic atoms in optical lattices. The highly controllable experimental setting discussed in this work, has opened the door to new insights into static and dynamical properties of ultracold quantum matter. One of the highlights reported here is the development and application of a novel time-resolved spectroscopy technique for quantum many-body systems. By following the dynamical evolution of a many-body system after a quantum quench, the author shows how the important energy scales of the underlying Hamiltonian can be measured with high precision. This

achievement, its application, and many other exciting results make this thesis of interest to a broad audience ranging from quantum optics to condensed matter physics. A lucid style of writing accompanied by a series of excellent figures make the work accessible to readers outside the rapidly growing research field of ultracold atoms.
Springer Handbook of Atomic, Molecular, and Optical Physics John Wiley & Sons
Clear, comprehensive graduate-level account of basic principles involved in all quantum optical resonance phenomena, hailed in Contemporary Physics as "a valuable contribution to the literature of non-linear optics." 53 illustrations.
Advances in Atomic, Molecular, and Optical Physics Academic Press
The field of quantum optics has witnessed significant theoretical and experimental developments in recent years. This book provides an in-depth and wide-ranging introduction to the subject, emphasising throughout the basic principles and their applications. The book begins by developing the basic tools of quantum optics, and goes on to show the application of these tools in a variety of quantum optical systems, including lasing without inversion, squeezed states and atom optics. The final four chapters are devoted to a discussion of quantum optical tests of the foundations of quantum mechanics, and to particular aspects of measurement theory. Assuming only a background of standard quantum mechanics and electromagnetic theory, and containing many problems and references, this book will be invaluable to graduate students of quantum optics, as well as to researchers in this field.
Introduction to Modern Quantum Optics Springer Nature
Quantum mechanics does away with the distinction between particles and waves, and one of the more interesting implications of the wave/particle duality - the discovery that atoms may be manipulated in ways analogous to the manipulation of light with lenses and mirrors - has formed the basis for the relatively new field of atom optics. Pierre Meystre's Atom Optics is the first book entirely devoted to this exciting area of research. Reference links to the leading journals in the field, links to research sites, graphics, and updates can be found online.
Quantum Optics Courier Corporation
Principles of Laser Spectroscopy and Quantum Optics is an essential textbook for graduate students studying the interaction of optical fields with atoms. It also serves as an ideal reference text for researchers working in the fields of laser spectroscopy and quantum optics. The book provides a rigorous introduction to the prototypical problems of radiation fields interacting with two- and three-level atomic systems. It examines the interaction of radiation with both atomic vapors and condensed matter systems, the density matrix and the Bloch vector, and applications involving linear absorption and saturation spectroscopy. Other topics include hole burning, dark states, slow light, and coherent transient spectroscopy, as well as atom optics and atom interferometry. In the second half of the text, the authors consider

applications in which the radiation field is quantized. Topics include spontaneous decay, optical pumping, sub-Doppler laser cooling, the Heisenberg equations of motion for atomic and field operators, and light scattering by atoms in both weak and strong external fields. The concluding chapter offers methods for creating entangled and spin-squeezed states of matter. Instructors can create a one-semester course based on this book by combining the introductory chapters with a selection of the more advanced material. A solutions manual is available to teachers. Rigorous introduction to the interaction of optical fields with atoms Applications include linear and nonlinear spectroscopy, dark states, and slow light Extensive chapter on atom optics and atom interferometry Conclusion explores entangled and spin-squeezed states of matter Solutions manual (available only to teachers)

Current Trends in Atomic Physics Elsevier

This book responds to the call for a clear description of the role of basic science in meeting societal needs. It gives examples of societal benefits of atomic, molecular, and optical (AMO) science in a number of key areas, including industrial technology, information technology, energy, global change, defense, health and medical technology, space technology, and transportation. This volume highlights the role of lasers in trapping, cooling, and manipulating individual atoms and molecules to make possible ultraprecise atomic clocks, structural engineering at the atomic level (nanotechnology), and new approaches to the study of deoxyribonucleic acid (DNA). AMO science is shown to be a field that is both an intellectually important basic science and a powerful enabling science that supports many other areas of science and technology.